Cybersecurity in Health Systems

Digital Threats, Real-World Consequences

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Date: 5/14/26

Disclosures

The planner(s) and speaker(s) have indicated that there are no relevant financial relationships with any ineligible companies to disclose.

Learning Objectives

At the end of this session, learners should be able to:

- Identify common methods for cyberattacks
- Summarize the means health organizations can use to mitigate cyber risks
- List cybersecurity best practices for healthcare teammates
- Distinguish the risks and benefits of artificial intelligence in cybersecurity

Outline

- Background of Cybersecurity
  - Cyberattack methods
  - Methods of attack prevention
- Case Studies
- Promoting cybersecurity at a user level
- Artificial Intelligence in Cybersecurity

Abbreviation Key

- AI: Artificial Intelligence
- ACK: Acknowledge
- CVE: Common Vulnerabilities and Exposures
- DDoS: Distributed-Denial-of-Service
- DoS: Denial-of-Service
- EHR: Electronic Health Record
- HTTPS: Hypertext Transfer Protocol Secure
- ID: Identification
- IDS: Intrusion Detection System
- IoT: Internet of Medical Things
- IP: Internet Protocol
- LLM: Large Language Model
- MAR: Medication Administration Record
- MFA: Multi-Factor Authentication
- MitM: Man-in-the-Middle
- PA: Prior Authorization
- RaaS: Ransomware-as-a-Service
- SYN: Synchronize
- SYN-ACK: Synchronize-acknowledge
- SIEM: Security Information and Event Management
- VPN: Virtual Private Network

Background of Cybersecurity

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Definitions

Cybersecurity:

- The practice of protecting systems, networks, devices, and data from digital attacks

Cyber-attack:

- A malicious and purposeful attempt to breach an individual's or organization's information system

Cisco. What is cybersecurity? 2025.
Cisco. What is a cyberattack? 2025.

Healthcare Cyberattack Motives

- Healthcare is an easy target
  - Healthcare IT environments are complex which can be difficult to secure
  - Old devices and software are vulnerable
- Healthcare systems store large amounts of valuable data
  - Social security numbers and other demographics for identity fraud
  - Sensitive medical information can be used for extortion

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HIPAA Journal. Why do criminals target medical records? 2026.

Targets

- Electronic Health Record (EHR)
- Internet of Medical Things (IoMT)
  - Infusion Pump
  - Imaging
    - MRI machine
    - CT scanner
    - X-ray machine
  - Implants
    - ICD
    - Pacemaker
  - Glucometer
  - Insulin Pump

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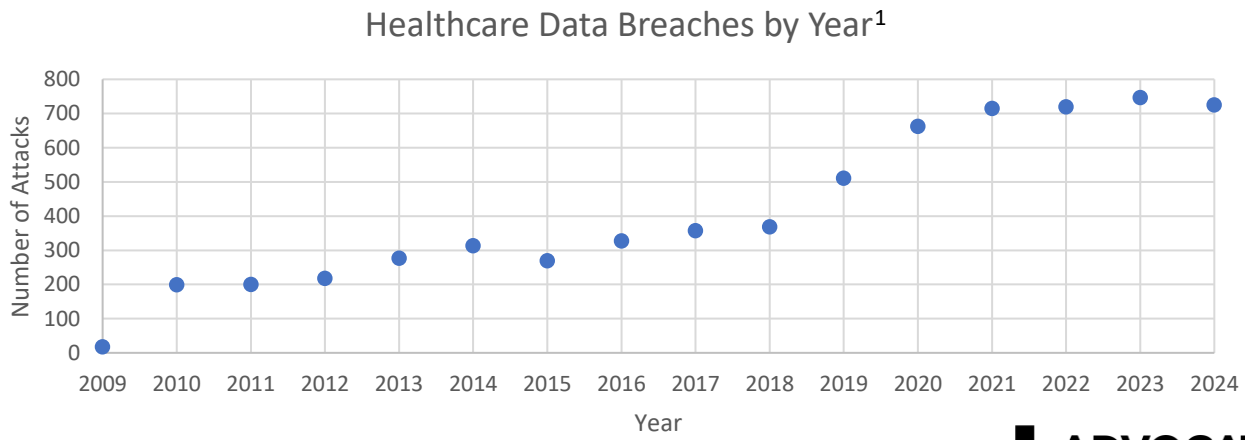
Clarke M, Martin K. Managing cybersecurity risk in healthcare settings. 2024.

Cyberattack Statistics

- Number of healthcare data breaches has been steadily increasing each year
  - From 18 attacks in 2009 to 725 attacks reported in 2024
    - Involving breaches of 500 or more records



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HIPAA Journal. 2024 healthcare data breach report. 2025.

Cyberattack Statistics

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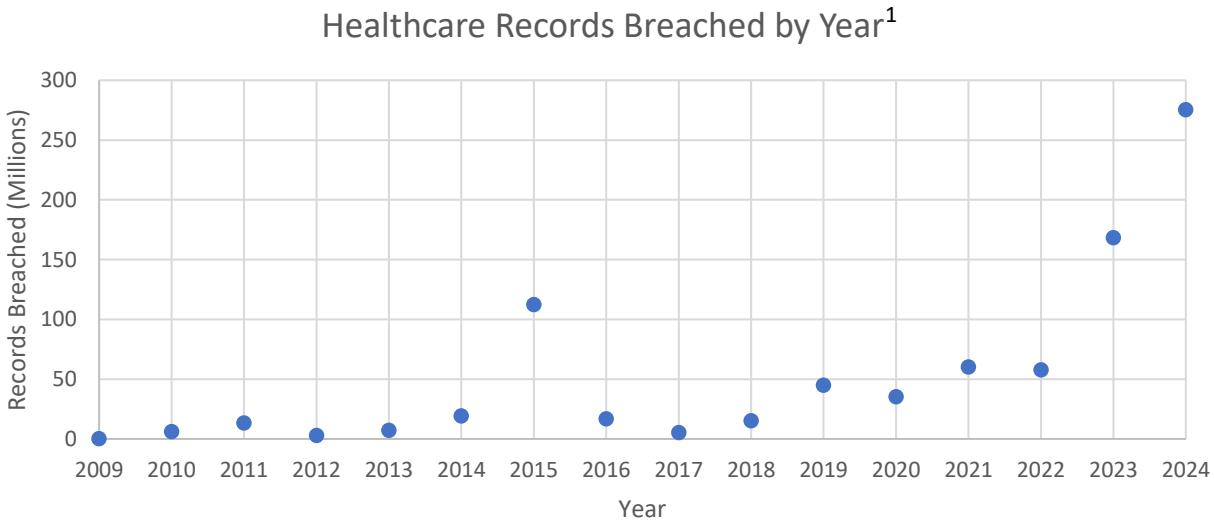

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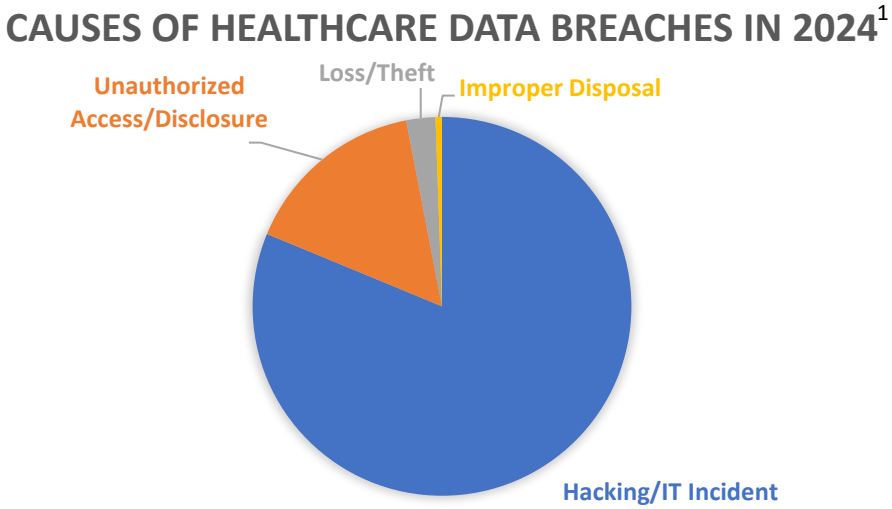
HIPAA Journal. 2024 healthcare data breach report. 2025.

Cyberattack Statistics

- Majority of healthcare data breaches are due to hacking/IT incidents



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HIPAA Journal. 2024 healthcare data breach report. 2025.

Types of Cyberattacks

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Malware

- Definition: Malicious software made to harm, disrupt, or gain unauthorized access to systems
- Ransomware: Malware that locks down files or systems and demands payment to restore access
- Spyware: Malware that covertly tracks user activity
- Viruses: self-replicating software that requires a host program to run to make it active
- Worms: self-propagating program that independently runs that can consume computer resources destructively
- Trojans: Seemingly useful program but with a hidden and possibly malicious function

Cisco. What is a cyberattack? 2025.
NIST. Virus. 2026.
NIST. Worm. 2026.
NIST. Trojan horse. 2026.

Phishing

- Definition: Social engineering technique to obtain sensitive data through fraudulent solicitation via an email or website
  - The solicitation often imitates legitimate businesses or a reputable person
- One of the means that malware is introduced into a system

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NIST. Phishing. 2026.

Man-in-the-Middle (MitM)

- Definition: Attacker places themselves between two communicating targets to steal sensitive information or alter information being sent
  - Between two users
  - Between a user and an application
- Entry points for attacker
  - Phishing attacks
  - Public Wi-Fi hotspots
    - Fewer security protocols

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IBM. What is a man-in-the-middle attack? 2026.

Denial-of-Service (DoS)

- Definition: Attack that renders a targeted host or network unusable due to being flooded with traffic
  - Distributed Denial-of-Service (DDoS):
    - Subtype of DoS where the attack occurs with multiple machines operating together
    - Often uses a botnet
      - Network of compromised devices
    - Increases attack power

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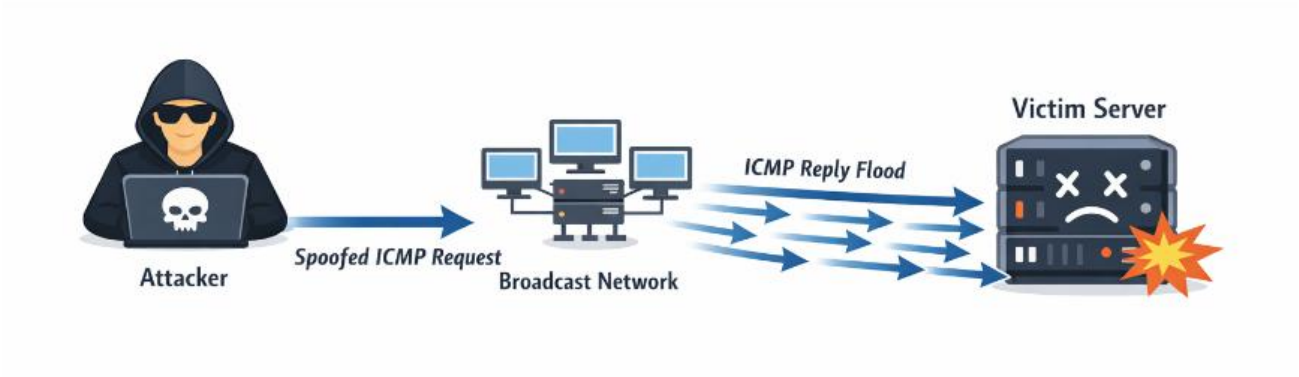
CISA. Understanding denial-of-service attacks. 2026.

Denial-of-Service

- Smurf Attack:
  1. Attacker spoofs a target's IP address and sends internet control message protocol broadcast packets (pings) to numerous hosts
  2. Hosts reply to the target's IP address (flooding it with responses)



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CISA. Understanding denial-of-service attacks. 2026.

Denial-of-Service

- SYN Flood
  - Attacker sends a request to connect to a targeted server but does not complete the “three-way handshake” to create a connection
    - Attacker repeats this process to saturate connection ports
  - The incomplete handshake leaves the connected port in an occupied status so other legitimate users can’t connect

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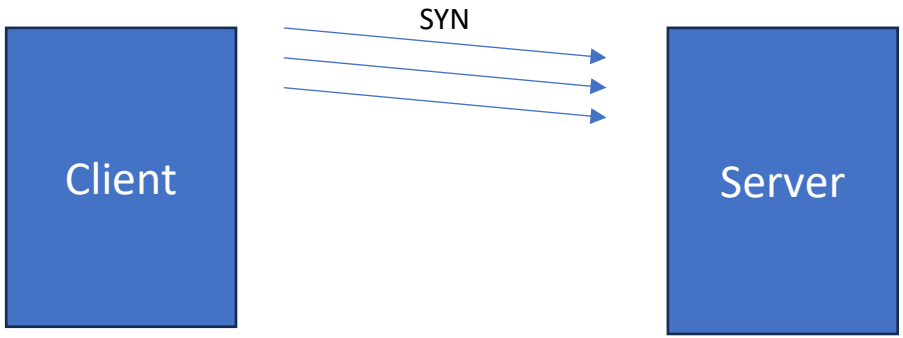

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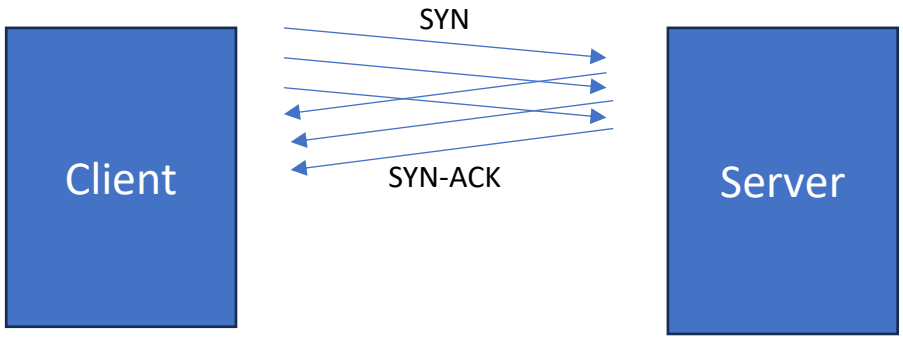

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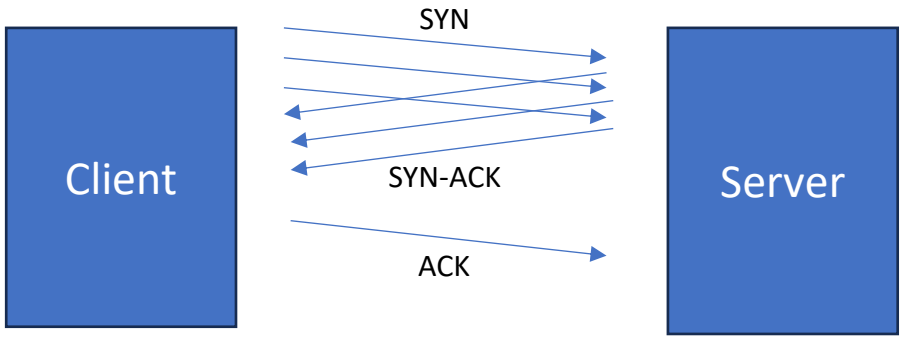

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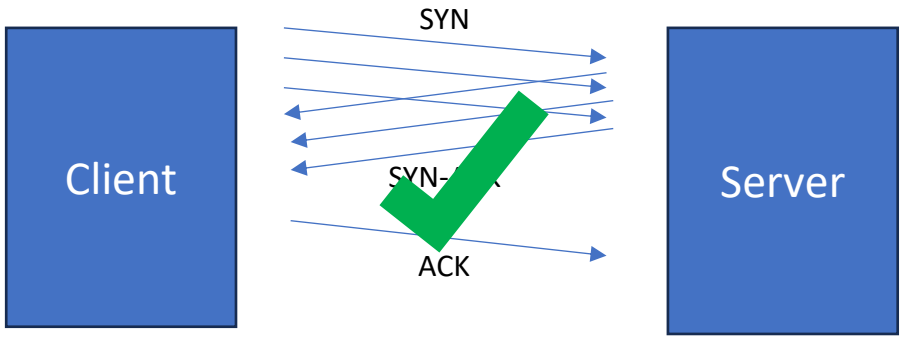

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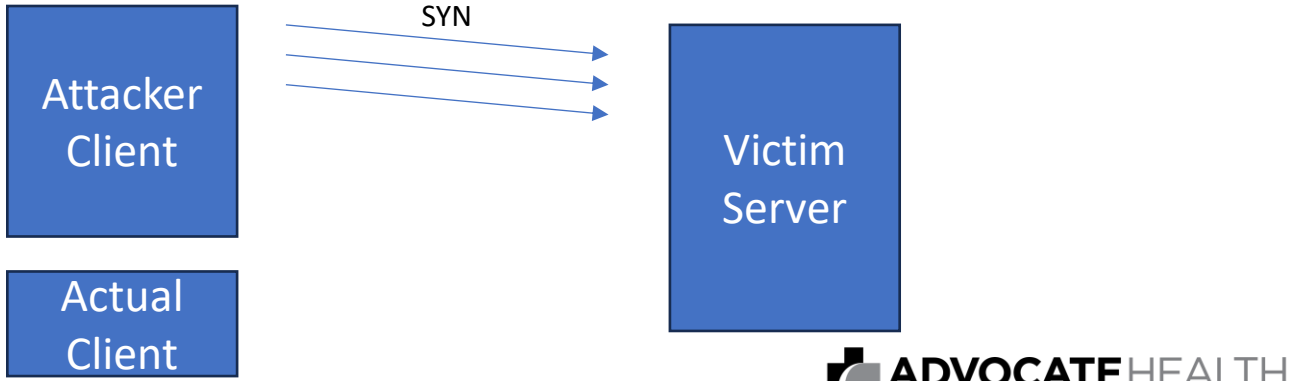

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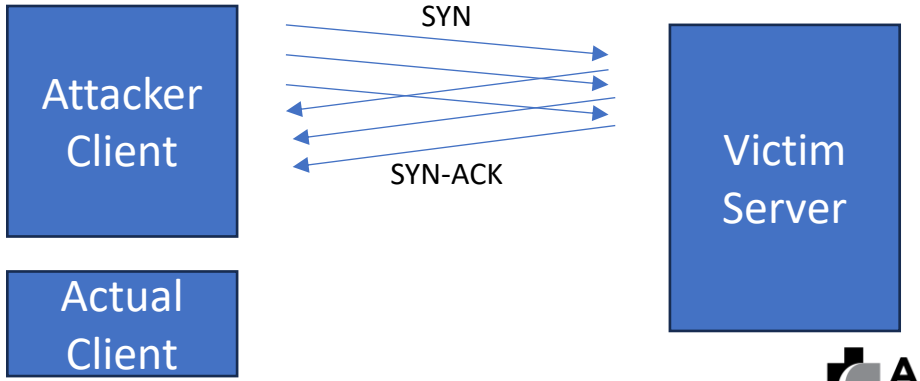

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CISA. Understanding denial-of-service attacks. 2026.

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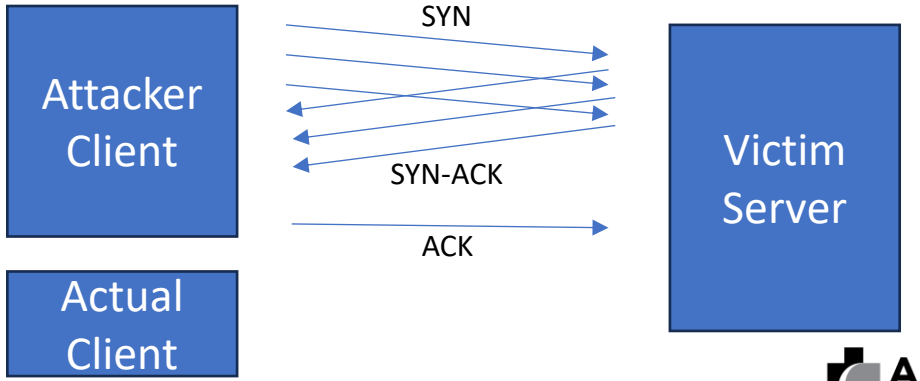

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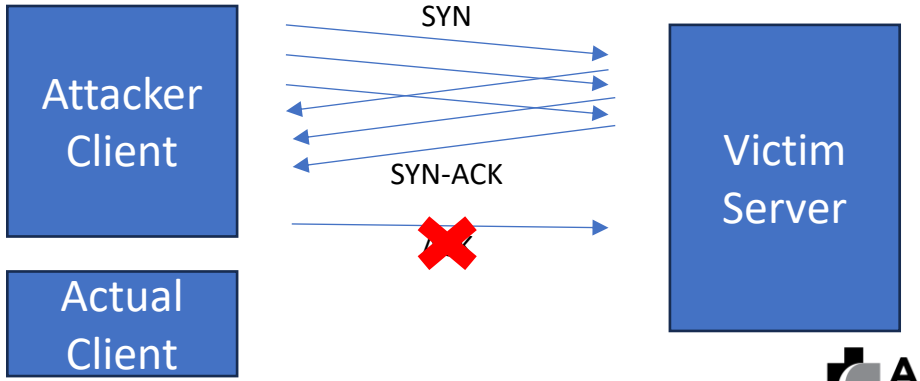

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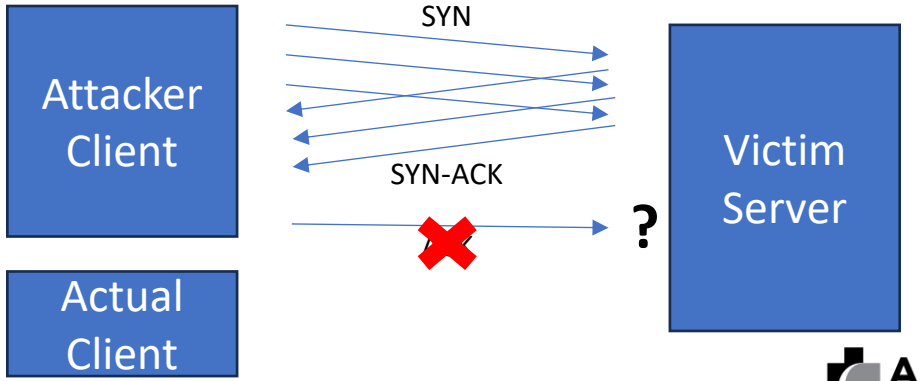

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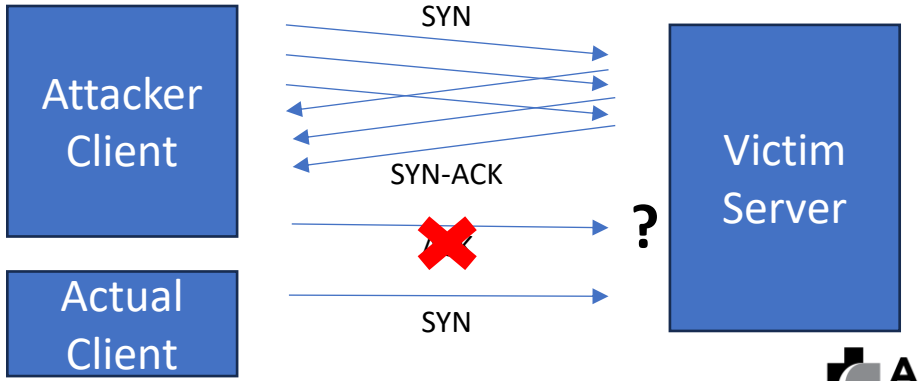

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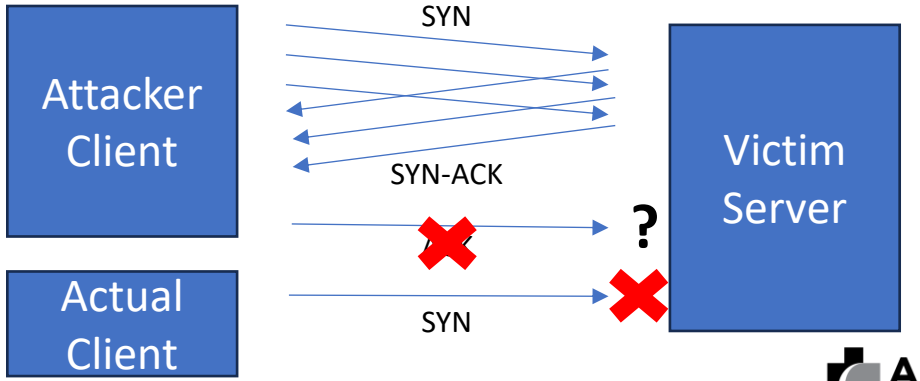

CISA. Understanding denial-of-service attacks. 2026.

Login Attacks

- Brute Force Attack: Uses automation to systematically try passwords for a user ID until the correct one is entered
- Password Spraying: Attempts one common passwords across many accounts
- Password Stuffing: Uses stolen login combinations across multiple sites

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CrowdStrike. What is a brute force attack? 2026.

Assessment Question #1

What type of cyberattack relies on not completing a “three-way handshake” to establish a connection to a server?

A. Smurf Attack
B. SYN Flood
C. Phishing
D. Man-in-the-Middle

Combating Cyberattacks

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Internal Controls

- Preventative
  - Stops an incident before it happens
- Detective
  - Identifies an incident during or soon after an attack
- Corrective
  - Reduces the impact of an incident and restores operations

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CyberQuizzer. Preventive, detective, and corrective controls. 2025.

Preventative Controls

- Firewall
  - Security device that monitors and filters incoming and outgoing network traffic
    - External threats: viruses, phishing emails, DoS attacks
    - Internal threats: exfiltration of data
  - Serves as a barrier between external networks and a trusted internal network

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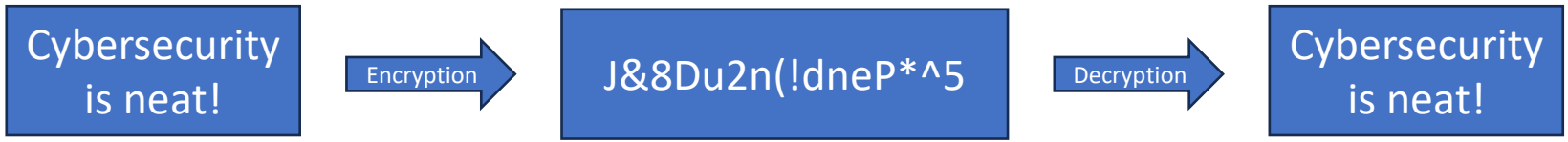
Fortinet. Firewall. 2026.

Preventative Controls

- Encryption
  - Information is converted to an unreadable text (ciphertext) so it is useless to unauthorized users
  - Authorized users can decipher the text



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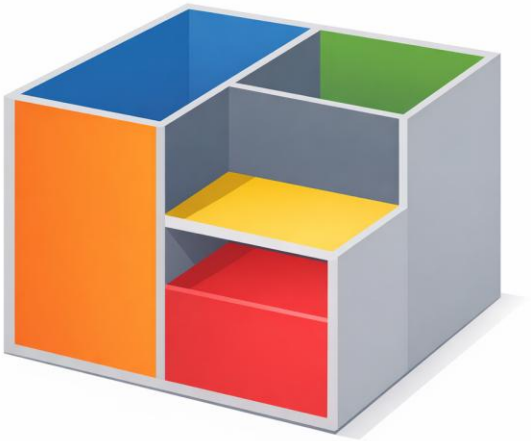
Fortinet. Encryption. 2026.

Preventative Controls

- Network Segmentation
  - Divides a computer network into smaller isolated sections to restrict communication
  - Can limit the spread of an attack
    - One segment does not automatically give access to another
  - Example: Segmenting ADS cabinets, infusion pumps, payroll, and email from each other



GeeksforGeeks. What is network segmentation? 2026.

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Preventative Controls

- Principle of Least Privilege (PoLP)
  - Concept of granting users the minimum level of access to perform their duties
    - Reduces the risk of both accidental or intentional misuse of information
- Update software regularly
  - Software can contain security flaws
  - Vendors release patches once flaws are identified
  - When patches are released, the security vulnerabilities may become public knowledge
    - Attackers can reverse engineer the patches to create exploits for systems that haven't been updated

Fortinet. Principle of least privilege, 2026.
Kukoyi M. Software updates and patches, 2024.

Detective Controls

- Antivirus
  - Scans and detects malware on a device
  - Types of Detection
    - Signature-based: scan looks for known malware signatures from a database
      - Fast and low false positives
    - Behavior-based: continuous monitoring that analyzes process abnormalities
      - Can require more processing power and higher false positives

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SentinelOne. Signature-based vs behavioral AI detection. 2026.

Detective Controls

- Intrusion Detection Systems (IDS)
  - Application that monitors network or system activity and identifies suspicious or malicious activity
  - Types of IDS
    - Network IDS: Monitors incoming and outgoing traffic from all devices connected to an organization's network
    - Host-based IDS: Monitors activity on an individual host connected to the internet/organization's intranet

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Fortinet. Intrusion detection system (IDS). 2026.

Detective Controls

- Security Information and Event Management (SIEM)
  - Centralized cybersecurity system that
    - Collects and analyzes security events from different sources across an organization
      - Antivirus
      - Intrusion Detection System
      - Identity and Access Management Tools
      - Email Security Tools
    - Alerts security team as needed

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Behl A, Behl K. Cybersecurity detective controls. 2015.

Corrective Controls

- Wide variety of examples
  - Investigating how an incident occurred to help close possible cybersecurity defense gaps
  - Software patch
  - Restoring systems from backups
  - Education to end users
  - Revised policies and mitigation strategies

ReasonLabs. Corrective controls. 2026.
ScienceInsights. What is a corrective control? 2026.

Assessment Question #2

A health system identified that a server was compromised due to a software vulnerability. The health system's IT security team removed the server from the network and resolved the vulnerability with a software patch before restoring access. What type of cybersecurity control is primarily demonstrated by the actions taken by the IT security team?

A. Preventative Control
B. Detective Control
C. Corrective Control

Healthcare Teammate Cybersecurity Best Practices

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Best Practices

- Use strong passwords
  - At least 16 characters long
  - Mix of upper and lowercase letters, numbers, and symbols
  - Only use for one account
- Use caution while on public WiFi
  - Attackers can access and compromise sensitive information
  - Ensure websites start with http**s**
  - Consider using a VPN

CISA. Require strong passwords. 2026.
FCC. How to protect yourself online. 2026.

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Best Practices

- Multi-Factor Authentication (MFA)
  - Method of verifying identify by requiring at least two proofs
  - Factors include:
    - Something you know (e.g. password)
    - Something you have (e.g. mobile phone)
    - Something you are (e.g. biometric)
- Backup Data
  - Prevent data loss due to a cyberattack
  - Follow the 3-2-1 rule
    - 3 copies of important files
    - 2 different types of storage
    - 1 copy stored off site

IBM. What is multi-factor authentication? 2026.
NIST. Multi-factor authentication. Updated 2026.
CISA. Back up business data. 2026.

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Best Practices

- Be aware of phishing
  - Review phishing educational materials
  - Look for suspicious e-mails, text messages, or voice calls
    - Communications that imply urgency or request unusual tasks be completed
  - Validate the source through alternate means of communication
  - Report identified malicious communications

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U.S. Dep't of State. Understanding and preventing phishing attacks. 2026.

Best Practices

- Be prepared for downtimes
  - Know your health system's downtime procedures
  - Practice downtime workflow drills
  - Prepare for the loss of medication safeguards
  - Know alternate means of communication

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AMC PSO. Patient safety guidance for EHR downtime. 2017.

Assessment Question #3

Mike logs into his email first by entering his password and then by scanning his fingerprint. Which of the following is NOT a type of factor Mike used when performing this example of MFA?

A. Something you know
B. Something you have
C. Something you are

Case Studies

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Change Healthcare: 2024

Background

- Victim: Change Healthcare, a healthcare clearing house and a subsidiary of United Health Group
- Attacker: Individuals associated with BlackCat ransomware group
  - Ransomware-as-a-Service (RaaS) group
- Attack:
  - Infiltrated the network through a remote access Citrix portal that lacked MFA
  - BlackCat exfiltrated large amounts of data then deployed ransomware

Security.org. Change Healthcare data breach. 2026.
HIPAAGuide. Change Healthcare data breach. 2025.

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Change Healthcare: 2024

Outcome

- Change Healthcare shut down systems to prevent further spread
- Paid $22 million ransom to BlackCat in exchange that the data would be deleted
- Over 190 million individuals affected
- Total impact of over $3 billion on UnitedHealth Group

Lessons Learned

- Utilize MFA
- Update system regularly

Security.org. Change Healthcare data breach. 2026.
HIPAAGuide. Change Healthcare data breach. 2025.

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Lurie Children's Hospital: 2024

Background

- Victim: Lurie Children's Hospital in Chicago, IL
- Attacker: Rhysida
  - RaaS group
- Attack
  - Method of attack is not public but some suspect it was due to an outdated identification system
  - Accessed patient data and deployed ransomware

CISA. #StopRansomware: Change Healthcare advisory (AA23-319A). 2023.
HIT Consultant. Legacy Active Directory ransomware risks. 2026.
HIPAA Journal. Lurie Children's Hospital cyberattack. 2024.

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Lurie Children's Hospital: 2024

Outcome

- Forced IT systems offline
  - Reverted to downtime workflows for several months
- Over 790,000 individuals affected
- Rhysida demanded a $3.4 million ransom
  - Not paid
  - Group claims to have sold the patient data

Lessons Learned

- Keep systems updated

CISA. #StopRansomware: Change Healthcare advisory (AA23-319A). 2023.
HIT Consultant. Legacy Active Directory ransomware risks. 2026.
HIPAA Journal. Lurie Children's Hospital cyberattack. 2024.

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Ascension Health: 2024

Background

- Victim: Ascension Health
  - One of the largest nonprofit health systems in the nation
- Attacker
  - Believed to be the Black Basta ransomware group
    - RaaS group
- Attack
  - Employee inadvertently downloaded a malicious file
  - Ransomware was used to encrypt files

CISA. #StopRansomware: Black Basta (AA24-131A). 2024.
HIPAA Journal. Ascension cyberattack. 2024.

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Ascension Health

Outcome

- Patient data stolen affecting 5.6 million individuals
- Critical systems were taken offline for ~6 weeks
- Forced ambulances to be diverted and for pharmacies to close
- Contributed to their $1.1 billion net loss in the 2024 fiscal year

Lessons learned

- Educate staff about cybersecurity

CISA. #StopRansomware: Black Basta (AA24-131A). 2024.
HIPAA Journal. Ascension cyberattack. 2024.

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Artificial Intelligence (AI) in Cybersecurity

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AI in Cybersecurity

- AI: An umbrella term to describe the ability of a computer system to perform tasks typically requiring human intelligence
- Generative AI: Creates new patterns and content
  - Relies on prompts
  - Large Language Model (LLM): Subset of genAI that understand and generate human language
- Agentic AI: Reasons and makes decisions autonomously
  - Doesn’t require human prompts

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IBM. Agentic AI vs generative AI. 2026.

AI in Cybersecurity

- Threat detection
  - Detects abnormal behavior by learning users' typical behavior
    - Login patterns
    - File access histories
    - Application usage
    - Network activity
  - Traditional systems are based on rules

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Mohamed N. AI and machine learning in cybersecurity. 2025.

AI in Cybersecurity

- Malware Detection
  - Can identify malware based on learning patterns from malware signatures
  - Able to better identify polymorphic malware
- Phishing Detection
  - Can identify if a communication is phishing based on patterns found in phishing databases
    - Can recognize linguistic cues that indicate malicious intent

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Mohamed N. AI and machine learning in cybersecurity. 2025.

AI in Cybersecurity

- Automation
  - Traditional cybersecurity involves manual workflows
  - Traditional SIEM systems often struggle with high data volume and false positive rates
    - AI can review logs and filter out false positives
  - AI-detected compromises can automatically trigger predefined response actions
    - Reduces mean time to detect and respond

Mohamed N. AI and machine learning in cybersecurity. 2025.
Roy S. AgenticCyber multi-agent cybersecurity system. 2025.

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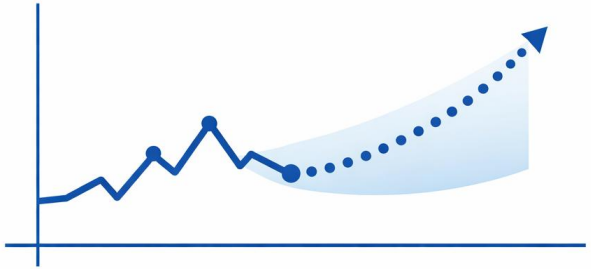
AI in Cybersecurity

- Proactive Decision Making
  - AI can forecast possible threats and vulnerabilities using predictive analytics before they are exposed by attackers
  - AI can help identify possible system exploitations and ranks its severity
  - Allows organizations to continuously strengthen their security capabilities



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Mohamed N. AI and machine learning in cybersecurity. 2025.

Risks of AI in Cybersecurity

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AI in Cybersecurity: Risks

- Although AI is an effective tool it does have limitations/risks associated with its use
  - Bias: AI is only as good as the data it's trained on
  - Transparency: AI is complex which can sometimes make it difficult to understand how it came to certain decisions
    - "Black Box" AI

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GeeksforGeeks. AI in cybersecurity. 2025.

AI in Cybersecurity: Risks

- Privacy Concerns
  - Cybersecurity using AI typically involves collecting and analyzing large amounts data
- AI Powered Attacks
  - Hackers can utilize AI as a tool to attack more efficiently

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Guembe B et al. AI-driven cyber attacks. 2022.

AI Attacks: Logins

- Brute-Force AI
  - Utilizes an AI agent alongside an LLM to identify login pages
    - Agent sends webpages to LLM which scans the page for login fields
  - Attack
    - Brute Force
    - Password Spraying

Guembe B et al. AI-driven cyber attacks. 2022.

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AI Attacks: Phishing

- Attackers can give an LLM prompts to generate phishing attacks
  - Rate of phishing attack creation is faster
  - AI can eliminate signs of a phish
    - Grammatical and spelling errors
    - Unusual tone
  - Attacks are more believable
    - Tailored to individual recipients
    - Mimic linguistic style of the individual

Sami M, et al. Computational models for sign language recognition. 2023.
Kumar S, Menezes A, Giri S, Kotikela S. What the phish! Effects of AI on phishing attacks and defense. 2024.

AI Attacks: Deepfakes

- AI generated media (e.g. pictures, audio, video) impersonating an individual doing something never actually done
- Attackers can
  - Feed generative AI media of an individual to impersonate
  - Give AI a script to perform
  - Send the deepfake to victims

Deepfake of Morgan Freeman that I have generated

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Dash B, Sharma P. Are ChatGPT and deepfake algorithms endangering the cybersecurity industry? 2023.

AI Attacks: Ransomware

- PromptLock
  - Proof of concept only
- AI agent alongside an LLM to perform all aspects of a ransomware attack
  - Identifies what systems/organizations to attack
  - Analyzes what data is sensitive and valuable
  - Deploys the attack
  - Writes the ransom note

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ESET Research. AI-powered ransomware (PromptLock). 2025.

AI Attacks: CVE Exploits

- Common Vulnerabilities and Exposures: Publicly disclosed security vulnerability reports
- Attackers can use AI tools like “CVE-Genie” (AI agent) to
  - Feed CVEs to an LLM to read and send back pertinent information back to the agent
  - Have the AI agent understand the vulnerability and write an exploit

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Ullah S, et al. Automated multi-agent framework for reproducing CVEs. 2026.

AI Attacks: Cases

- United Kingdom engineering firm Arup tricked into sending $25 million to fraudsters - 2024
  - Employee transferred money following a video call with senior management
- Anthropic (Claude) AI powered cyber espionage campaign - 2025
  - Chinese state-sponsored group used Claude code to:
    - Support reconnaissance, vulnerability discovery, exploitation, credential harvesting, data analysis and exfiltration
    - Execute 80-90% of the tactical operations independently

World Economic Forum. Deepfake-enabled cybercrime (Arup case). 2025.
Anthropic. Disrupting the first reported AI-orchestrated cyber espionage campaign. 2025.

Assessment Question #4

Which of the following correctly distinguishes the risks and benefits of AI in cybersecurity?

A. AI can increase efficiency by filtering out false positive threats, but may introduce bias if models are trained on poor quality data

B. AI can automate incident response, but slows down response times

C. AI prevents all cyber attacks, but raises privacy concerns

D. AI always identifies threats correctly, but its decision-making process may lack transparency

Summary/Conclusion

- Cyberattacks are a growing threat in healthcare
- Attacks can affect more than an EHR
- There are a variety of attack methods
- Preventative, detective, and corrective controls are used to combat cyberattacks
- AI enhances cybersecurity but comes with risks

Questions?

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